Proton Conducting Dense Ceramic Membranes for Hydrogen Separation and Membrane Reactor Applications

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Proton-conducting ceramic membranes are hydrogen semi-permeable at high temperatures. These membranes, if their hydrogen permeation flux is further improved, will find many energy-related applications involving separation of hydrogen. Recently we have prepared a modified strontium cerate material with a significantly higher hydrogen permeability through improvement of the electronic conductivity of the material. The present project is aimed at preparation of thin (1-10 μm) membranes of the modified strontium ceramic material with improved hydrogen permeation flux, and investigation of the electric and hydrogen permeation properties of this new membrane. Currently we are investigating the use of two simple and effective methods, RF sputtering and inorganic-organic polymeric sol coating, to prepare thin modified strontium cerate films on mesoporous yttria stabilized zirconia and cerium oxide supports prepared by the sol-gel method. Theoretical study is focused on modeling of hydrogen permeation through the dense proton-conducting ceramic membrane based on the ambipolar approach considering transport of all three charged species (proton, electron and electron-hole). The gas-tightness, electric conductivity and other structural properties of the proton-conducting ceramic membranes will be characterized by several standard methods. We will also study experimentally hydrogen permeation through these membranes in temperature range of 600-900°C. These permeation data will be correlated to the electric conductivity data and analyzed with theoretical models to identify hydrogen permeation mechanisms.

List of Publications/Presentations (DE-FG26-00NT40818)

No publications yet

Papers Submitted for Presentation in Conferences:

X. Qi, S. Cheng and Y.S. Lin, "Modeling and Experimental Study of Hydrogen Permeation through Proton Conducting Ceramic Membranes", The Electrochemical Society Annual Meeting, September 2-7, 2001, San Francisco, California

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